

AVENGER **Products**

SAW BLADE INFORMATION & DADO HANDBOOK

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BRIEF HISTORY OF CARBIDE

This unique metal was invented in Germany 1930 where it was needed to machine hard metal, tool steel. Over the last 50 years, carbide has become the standard for all kinds of cutting tools. Many different grades have been formulated to cut exotic metals like stainless alloys, Inconel, Zirconium, and other space age alloys. Without the development of specific carbides it would be impossible to cut and machine these space age materials. The development of composite materials is ongoing. There are many diamond alloys where the synthetic diamonds are imbedded in a Tungsten Carbide Matrix. These materials will withstand very high temperatures and are ideal for high speed machining on CNC and computerized lathes and milling machine centers.

WHAT IS CARBIDE?

Carbide is a man made material consisting of Tungsten and Cobalt. For example, C-2 Carbide, the most common form, is 6% Cobalt and 94% Tungsten. Tungsten ore is milled to a fine powder, and then carbonized in a furnace at a high temperature. Carbon is added to form a very hard grain material, and then cobalt is used as a binder to hold the material together. The mixture of Tungsten and Cobalt is pressed to the desired shape in a pill press. Sometimes wax is added to help form the shape, and then the blank is sintered in a furnace at high temperature to melt the cobalt. The tungsten particles are not affected.

Most carbide can be silver soldered to a steel base. In many applications the carbide-cutting tip is held mechanically by screws or clamps, and the carbide cutting edge can be ground. However you must use diamond tools. Sharpening must be performed by a qualified facility. It is best to use machinery that has good stability so that the cutting angles can be ground accurately. Grinding carbides by hand with portable tools or bench grinding is not recommended.

TYPES OF CARBIDE: WHICH ONE IS RIGHT FOR ME?

Today there are thousands of different carbides, all formulated for different applications. Cutting metals, wood cutting, wear parts, punches, and dies. One must take into consideration that carbides are extremely hard. C-2 is 88-91HRC while tool steel is only 60-65. With the hardness comes brittleness. The harder it is, the more brittle. Carbides do not withstand impact well. Striking rocks or nails will break tips on tools like saw blades, drill bits and router bits. Different carbide formations will perform better under different applications. Softer carbides are used for mining and drilling of masonry and concrete, where as harder carbides are used for machining metal like tool steel and stainless alloys. Usually when you increase the cobalt percentage, the material becomes softer and the strength becomes greater. Today we can formulate the carbide to give us the best performance; we can work with many variables like particle size, (Micro grain carbides) and Titanium Zirconium to achieve optimum results. C-4 Carbides are somewhat harder than C-2 and are denser and will stay sharp longer especially when cutting glue laminated materials. These carbides are made using micro grain particles and generally have a cobalt binder with tungsten carbide but also have small amounts of titanium for added cutting life.

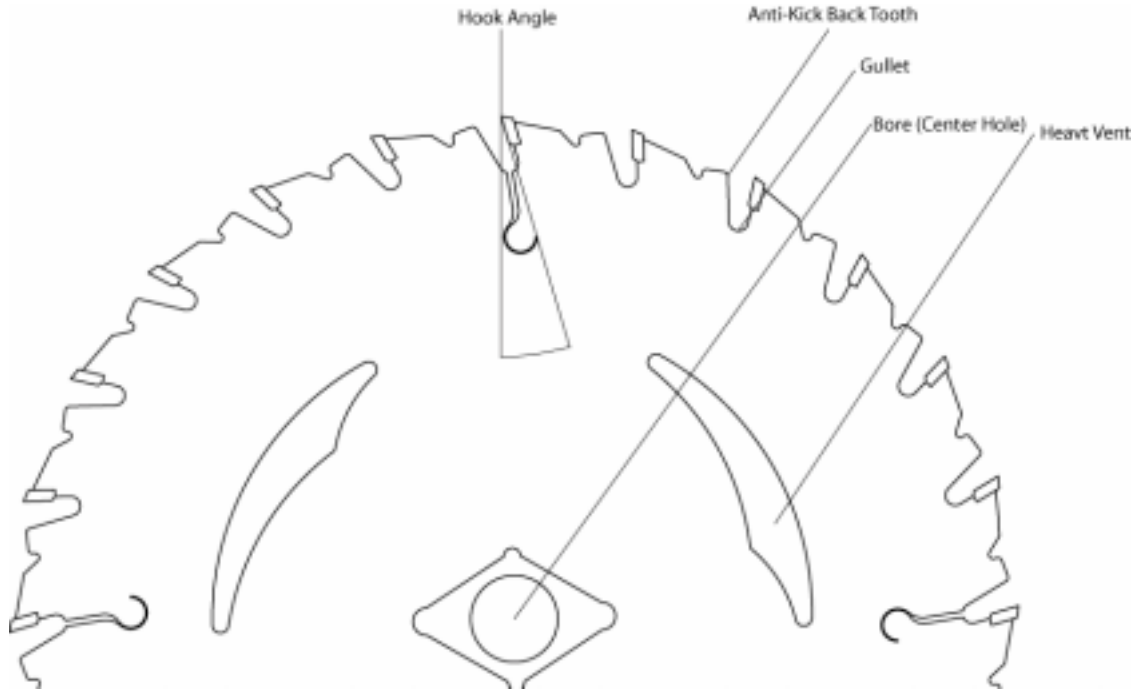
M-2 Tipped Saw Blades

M-2 is a special material combining Vanadium Carbide Molybdenum and Tungsten, soldered on the tips of saw blades. This material is very strong, and because of this metallurgical structure, the cutting tips have greater impact resistance. The 7 1/4" x 24T combo blade is ideal for use on portable saws. Can be used to rip and crosscut 2x4 lumber, although all other solid woods do not perform well. This type of blade should not be used for cutting plywood, particleboard, and other man made material. These synthetic materials contain glues and other resins that are very abrasive. Cutting these products is likely to erode the cutting edge and shorten the life of the blade. When a smoother finish is required, a 7 1/4" x 40 tooth blade is ideal for cutting normal wood like pine and fir. As a general rule, the more teeth, the smoother the cut result. The feed rate and the RPM's the blade is turning will also impact the smoothness of the cut. Turning the blade faster gives you more teeth in the cut. 10" x 40 tooth can be used on all stationary saws. On table, radial arm saws, and tabletop saws, make sure the blade rotation is in the right direction. Some Radial Arm Saws turn the opposite direction. Never cut concrete, steel, or other metals with these blades, (special diamond tipped blades should be used to cut concrete, brick and stone.) Triple Chip Tooth Tungsten Carbide tipped blades are available to cut aluminum, copper, and brass.

Carbide Tipped Saw Blades

Carbide tipped saw blades were introduced in the 1940s for industrial applications. Blades are expensive (7 1/4" x 8T \$30.00) Blades with Tungsten Carbide tips stay sharp longer, even when cutting man-made materials like particleboard, laminated plywood, melamine, and plastics. These blades are sharpened to very close tolerances. The body is hardened so it will not bend or flex. There are many kinds of blades to select from that will give you the best performance regardless of the material you are cutting.

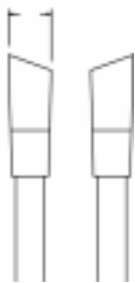
TERMS GLOSSARY



Anti-Kick Back Tooth

This is a safety feature to control the feed rate. If you push the blade into the cut, the faster it can load up, and jam resulting in the machine kicking back to the operator. The anti kick tooth will prevent this from happening.

Kerf



ATB (Alternate Top Bevel)

Alternate Top Bevel means the top of one cutting tip is beveled to the right, and the next is beveled to the left. Commonly the tips have a 15° angle producing a sharp cutting point. However the sharper the point the more fragile it is.

Bore (Center Hole)

Arbor hole diameter

Cold Rolled Steel

This is a low carbon material that is cold reduced by rolling in order to have stiffness. You start out with a minimum of two times the thickness needed after rolling. The cold reducing makes the material springy and is not hardened.

Dados

The best are saws and chipper sets. Outside saws are top bevel ground to pierce the fibers cleanly. The chipper is placed to cut the material between the saws. You can adjust the cut width by adding or removing the chippers. Providing the cut dimension, from 1/8" to 13/16", it is best that the chipper is placed to balance the unit. Shims can be used to give the precise groove width you need. The outside saw's cut deeper to give you a clean flat bottom. The chippers are designed to clean the material between the saws.

Gullet

The shape of the tooth rip blades has a deep gullet, to provide extra space for saw dust and chips to exit the cut more easily. Thus preventing build up and heat, commonly, rip blades have a cutting tip that has a straight top grind; this makes the edge stronger less likely to fracture when ripping.

Heat Vents

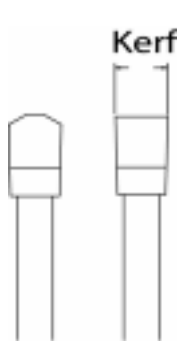
These are slots cut in the body of the saw blade to help the blade run cooler. If the blade becomes hot while cutting, the steel body can twist and warp damaging the blade beyond repair. Thin Kerf blades are especially susceptible to warping.

Hook

This is the angle of the cutting tip relative to the center hole. The greater the hook, the better the blade feeds its self into the material, you need a greater hook angle for ripping, less for cut off blades used for the miter box saws.

Kerf

The width of the cut can be found by measure the cutting tip. Thin Kerf blades take less power save material and cut cleaner.



Triple Chip Cutting Tooth

The geometry of the tip is designed to give the carbide the greatest strength and the chip load is distributed over 2 cutting tips. The first tip has a pyramid shape strait on top with the corners ground at a 45° angle, with this shape; it cuts out the center of the cut. The next tooth has a square configuration cutting the rest of the material. Usually the first tooth is a few thousandths closer to the center. The final action is more like milling than saw cutting. These blades are best for cutting non-ferrous materials like aluminum- brass, hard wood- like material chipboard and other laminates.

HOW CARBIDE TIPPED CIRCULAR SAW BLADES ARE MANUFACTURED

Our factory uses the newest technology to produce the highest quality products. The steel body is punched from a special alloy high carbon steel, expansion slots and heat vents are laser cut with the highest accuracy and consistency. Each saw body is heat treated, oil quenched, clamp drawn, stress relieved. Every one is inspected for hardness, strength and uniformity.



Each body is then surface ground to a precise thickness, inspected for flatness; the recessed pockets for the carbide tips are cleaned with glass bead blasting and treated with flux so that the carbide tips are guaranteed to bond completely. Each cutting tip is attached using a semi automatic high frequency tip soldering machine.

Every tip is stress tested to guarantee that the bond is 100%. We utilize a pull test with a specially designed hydraulic machine that applies 2.5 times the pressure than the cutting tip will be subjected to running under normal conditions. After silver soldering and inspection the tips are bead blasted to clean off any excess residue.



We then proceed with the grinding and shaping of each tooth. They are first rough ground with 180 grit diamond resinoid bonded grinding wheels. All four surfaces are ground, the face, both sides, and the top. This is accomplished with specialty built Japanese machines that use a full flood coolant system to prevent excessive heating. The first grinding operation is designed to generate clearance angles and bring the tip to the proper size. Then the finish grinding operations are accomplished with 600 grit wheels to produce an extremely smooth and sharp edge for extra long life.

Every blade is 100% inspected, each tooth must conform to a tolerance of $\pm 0.003''$. Concentricity is held to a total run out of $0.004''$. Flatness is held to $\pm 0.003''$. All cutting tips are checked to make sure there are no fractures or damaged points and that the clearance angles are consistent tip to tip. Every blade is identified with a date code.



Prior to the final packaging, each blade is cleaned and the body is polished and the tips are protected with split rubber tubing. They are then silk-screened with proper information, and dipped in a water soluble lacquer to prevent rust, and then packaged.

SAW BLADES FOR DIFFERENT APPLICATIONS

Thin Kerf Trim Blades



Thin Kerf Trim Blades have 60 to 80 and up to 100 cutting tips with a 4 – 5 degree hook angle and are made for clean cuts not ripping. These blades are not good for deep cuts over 2” thick. Laminated material like birch, mahogany, and walnut can be cut smoothly. A slow and steady feed rate will result in a clean chip free finish. Blade is suitable for table, miter and radial arm saws.

Non – Ferrous / Aluminum Cutting Blades



These blades are not for steel or iron. A lubricant is very helpful to keep the body of the blade clean and prevent chip build up. This type of blade can be used on table, miter and radial arm saws to cut tubing, channel, extruded shapes, flat bar and sheet made of aluminum, copper, brass and magnesium. Also works well in cutting plastic, laminated materials like melamine.

Ferrous / Steel / Iron Cutting Blades



The body is made with a special alloy steel. The cutting tips are C-6 Tungsten carbide with tantalum and titanium. These blades can be used to cut steel, iron, stainless steels, round, square, angle, flat bar and sheet. They are for use on both portable and stationary machines. Lubricant is helpful but not absolutely necessary. Triple chip tooth design, negative hook, large gullets, expansion slots and heat vents for cool running.

Rip Blades



These blades are designed for cutting with the grain on all kinds of solid wood material. They have an anti kick tooth configuration that controls the blades bite for better safety. The straight, flat top teeth cut clean and produce a flat bottomed kerf. The number of teeth greatly affects the smoothness of the cut. Blades with a small number of teeth are most suitable for ripping soft wood like pine and fir.



Miter Saw Blades

Some kinds of melamine, plastic and veneer materials are cut cleaner with triple chip tooth configuration. This prevents the plastic surface from chipping. When using your miter saw to cut small pieces like molding, make sure that the part to be cut is positioned directly under the center of the blade. If you are cutting with the back and the teeth are in an upswing, they can grab the material which will result in a dangerous condition that could cause injury.



Combination Blades

There are several varieties of combination blades. The best are novelty combination which consists of four tooth and raker. The ordinary 40 tooth alternate top ground design is generally a lower cost, they are made to be used on portable miter saws, table saws and radial arm saws. The number of teeth has a decisive impact on how smooth the blade will cut. Slowing down the feed rate will help if you are using a blade that has 40 teeth or less.



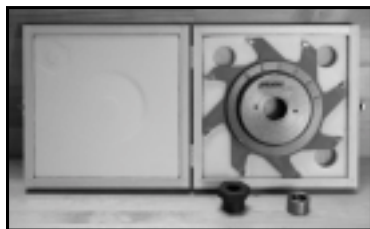
Blades for Cordless Machines

It is important to conserve battery life on these machines. So it is best to select blades that are thin kerf, with more aggressive hook angles and 20 degree alternate top bevel, because they will help conserve power and make the blade cut faster and fee easier. Because of the possibility of striking foreign objects like nails and rocks it is best to use C-1 or C-2 carbides that are not as hard and brittle and less likely to chip or fracture than C-3 or C-4 Grades.

ADJUSTABLE AND STACK DADO BLADES

There are several types and varieties of dado heads on the market, the most popular are stack dados, saws and chipper variety. There are also adjustable or wobble dados designed to use a single cutter that is tilted at various angles to supply different cutting widths.

ADJUSTABLE DADO SET



Item #10030

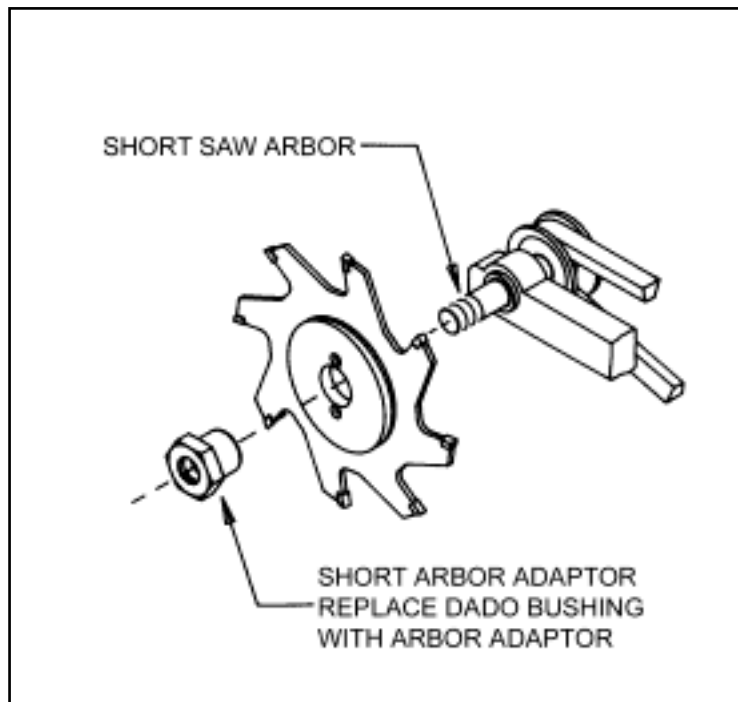
The wobble or adjustable dado is a single blade unit that can be tilted by rotating the flanges, causing the cutting blade to wobble from side to side a pre-determined amount as the unit revolves. These dados can cut grooves from a 1/4" to a maximum of 13/16" you can infinitely adjust the tool by rotating the flanges without removing it from the saw arbor. The dial is calibrated for continuous adjustment. This kind of tool is less expensive than the stack dados with saws and chippers, however because you have a limited number of teeth

they do not cut smooth and chip free on all kinds of wood. These tools will cut grooves with 90° corners and flat bottoms at the 1/2" to 5/8" setting at other settings the corners will deviate from 90° and the bottom will go from concave to convex. However, you can use your router or a wood file to clean up these cuts by hand.



Item #72411

Avenger™ products offer two varieties of adjustable dados. **Item #72411 7" x 24T** with molybdenum cutting tips is designed to be used by homeowners for cutting grooves in solid woods. It will provide a good quality cut at 1/2" and 5/8" settings at the 1/4" setting and at greater than 5/8" the cuts are less than perfect. Our **Item #10030 6 1/2" x 8T** Adjustable dado has C2 Tungsten carbide tips ground with a face bevel to provide excellent performance and smooth cutting in all kinds of wood. It is a precision unit that will provide good clean cuts at the full range. Both of these units can be used on 10" tabletop machines. We offer an arbor nut adapter that will provide extra safety when mounting these units on a machine with a short arbor.



STACK DADO SETS



Avenger manufactures three stack dado sets, **6" x 20T - Item #10032** (See Photo) five sections of four teeth each with a 20 degree bevel to the outside of the cut and one straight raker tooth. The two saws are slightly larger in diameter than the chippers. The large gullets are designed to accommodate nesting of the five tooth chippers. The unit is provided with four 1/8" chippers 0.125" steel body and 0.135" kerf, a 3/32" chipper 0.093" body and 0.105" kerf, also a 1/16" chipper 0.065" body, 0.075 kerf. The wider kerf on the

chippers allows them to overlap so the groove will be uniform with no gaps. With the five-tooth configuration on the chippers, they automatically fit in the gullets of the saws. This makes installation easier and safer.



We also provide an **8" x 30T - Item #10031** (See Photo) with five sections of five teeth each with a 20 degree bevel to the outside on 4 and one straight raker tooth. The same chippers are provided as our 6" unit.

In addition to these we carry an **8" x 42T - Item #10026** with six sections of seven teeth with a 20 degree bevel to the outside on six teeth and the seventh on is a straight raker. The same chippers are provided as with our other stack dado sets.

However the chippers have six teeth and with 42 teeth on the saws this dado provides the cleanest, smoothest cuts on even the most difficult laminated mahogany or birch material. This is the best dado set we offer.

All of our stack dado sets are provided with brass shims:

(2) – 0.010", (2) – 0.020", (2) – 0.025", (2) – 0.050"

INSTRUCTIONS FOR USING YOUR STACK DADO

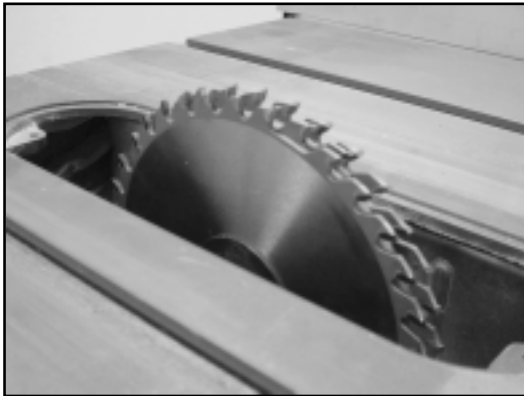


Unplug your machine then remove the screws holding down the throat plate to access the arbor and remove the arbor nut and washer. Place your inside saw on the arbor making sure that your rotation is correct, the flat face of the tooth should point towards the operator.

The chippers must nest in the gullet of the saw.



Conventional or Stack dados consist of two outside saws approximately 1/8" thick kerf. Usually they are designed with a left and right saw with beveled cutting tips. The saws are designed to cut slightly deeper than the companion chippers. Chippers are supplied of various thickness 1/4", 1/8" and 1/16". To set up your dado to make a particular width of cut first put the inside saw on the arbor, then the desired number of chippers and finally the outside saw.



Common Dado Cut Widths			Outside Blade	Outside Blade	Inside Chippers	
Inches	Fraction	MM	R/H	L/H	1/16	1/8
0.125	1/8"	3.1750	1			
0.313	5/16"	7.9502	1	1	1	
0.375	3/8"	9.5250	1	1		1
0.500	1/2"	12.7000	1	1		2
0.563	9/16"	14.3002	1	1	1	2
0.625	5/8"	15.8750	1	1		3
0.750	3/4"	19.0500	1	1		4

For 7/8" or 1" cuts it is necessary to place shims between the chippers to reach the desired cutting width. For small grooves like 1/8" you can use a single saw with no chippers or shims. It is desirable to make a test cut on a scrap piece of wood and make sure your dado groove is the proper width to insert your other piece of wood. If you need to make adjustments, place shims between the chippers to adjust the cut width. We include the 3/32" chipper and a variety of shim thicknesses to allow you to cut grooves of less than conventional widths.

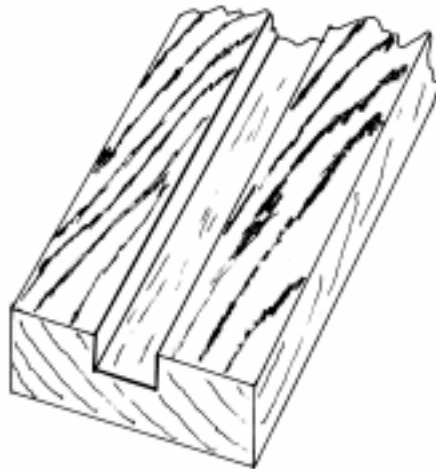


Tighten your arbor nut making sure that the chippers are well distributed and balanced and that the cutting tips are nesting in the large gullets on the saws. It is also important that the arbor shaft on your machine is long enough to accommodate the two saws and required chippers with adequate threads to hold the dado sets securely.

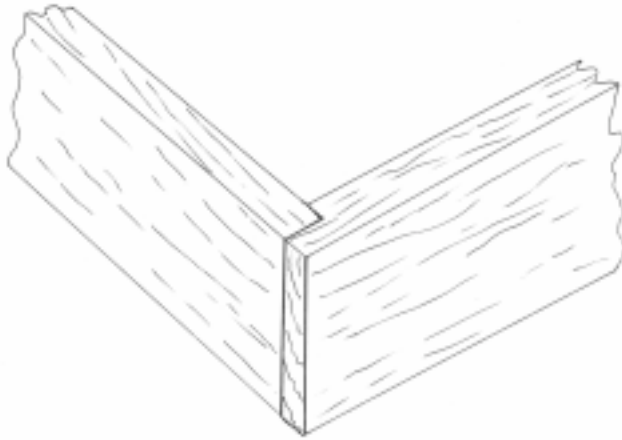
Stack dados with saws and chippers are available in many diameters with a wide variety of tooth configurations. The more teeth you have on the outside saws the cleaner the cut, this is especially

important if you are working with laminated materials like melamine. The chippers also perform better if you have more than two cutting tips, in addition four tooth or six tooth chippers help balance your dado set and make it run smoother.

THE CUTS YOU CAN MAKE

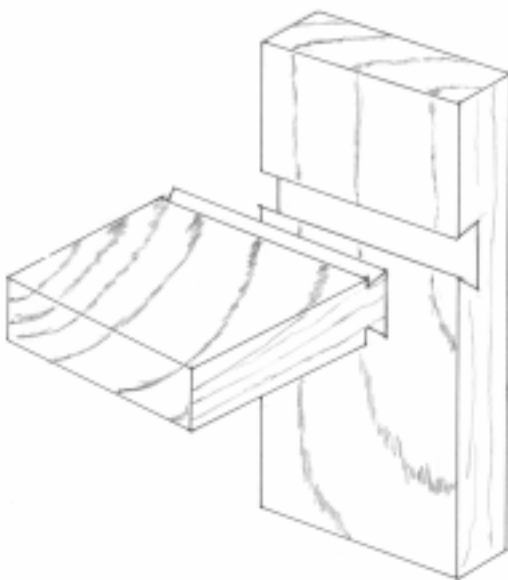
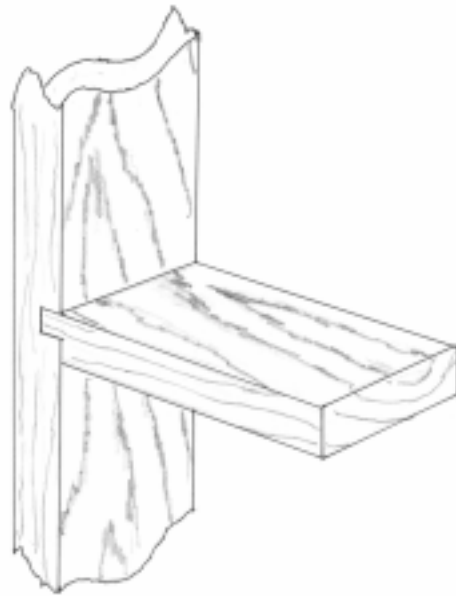


DADO • RABBETS • DOVE TAILS

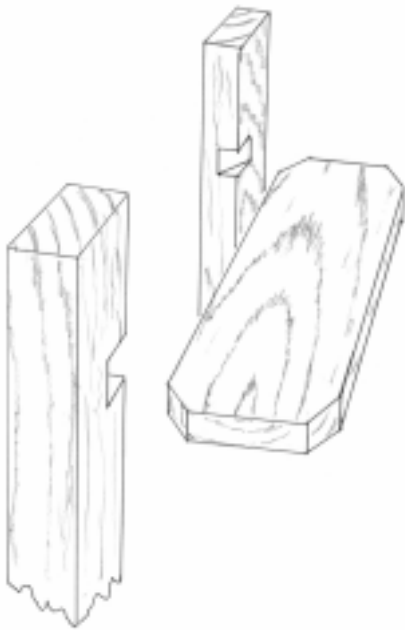


A dado joint is formed when one piece of wood is set into a groove or dado cut into another. There are many variations of a dado joint used in cabinetwork and furniture making. For instant a standard or housed dado joint is a groove that is cut in one piece of wood to the exact thickness of the second piece to be joined.

Sometimes a dado is also stopped on one or both sides. This is done by clamping one or two stop blocks to the rip fence. The dado tongue-and-rabbet accomplishes the same purpose as the drawer joint but is used when it is desirable to expose the cross grain at the side rather than at the end. If the two grooves and the end lap are all of the equal thickness, this gives a strong serviceable joint.



The fill-dovetail dado is made by first cutting a mortise or slot. Cut a dado to the narrowest width. Then replace the dado head with a single blade and adjust to an angle of 15 degrees. Make the angle cut on both sides to clean out the mortise. The tenon is cut in two steps with a single blade. First cut the kerfs in the faces. Then adjust the blade to a 15-degree angle and make the two shoulder cuts. The half-dovetail dado is cut the same way except that the angle cuts are made on only one side of the joint.



The corner dado is another popular joint, but it generally needs the added support of dowels.

The cogged dado joint has an uncut portion that is fitted into the main frame member as follows: Using a dado head, cut the groove in the reinforcing strip, then rout out the slots in the frame member and square their corners with a hand chisel.

The tongue-and-groove joint can be cut with a dado head. The groove is cut in a single pass with a head of the correct thickness. The matching tongue can be cut by placing a spacer collar between the blades of the dado head, with a chipper on the outside of each blade to remove waste stock. The tongue-and-groove joint is most frequently used to join flooring or siding.

WHAT SIZE DO I NEED?

Just because you have a 10" table saw does not mean you need a 10" diameter dado set, in most cases the grooves that you are going to cut are not more than 1 1/2" deep so even 6" dado sets will do the job. 8" diameter units are most versatile and suitable for virtually every kind of dadoing configuration you need to do. It is however important to note that 8" & 10" tabletop saws are generally not designed for stack dados with saws and chippers. Two problems are present; one the horsepower on these machines is minimal and usually not adequate to run a dado set. The second problem is, the arbor shaft is not long enough to accommodate saws and chippers and still have adequate threads to secure it safely.

There are adapters available that will extend the arbor to secure adjustable wobble dados to this light duty tabletop machines. Most stack units are provided with a shim set, this allows the user to adjust the cutting width precisely to the groove dimension needed for the particular application.

HOW TO TELL WHEN YOUR BLADE NEEDS SHARPENING

- Burn marks on the material you are cutting
- Material does not feed easily
- Pitch and sawdust build up on the teeth
- Broken corners, cracks or fractures in the carbide teeth

To extend the cutting life of your blade, make sure it's clean, remove pitch and sawdust buildup. Store your blades carefully and avoid contact with steel or iron surfaces. When cutting metal, use a spray on a lubricant.

SHARPENING

Carbides can not be sharpened with ordinary files or Aluminum Oxide grinding wheels. Diamond tools must be used. If the blade is not severely damaged polishing the cutting face with a diamond hone or lapping tool will restore the edge. If the blade has been used extensively and the points on the top of the teeth are damaged, the outside diameter must be resurfaced. This requires a tool and cutter grinding machine. It is not recommended that the ordinary user attempt this process. It is best to find a professional sharpening facility or return the blade to the factory for resurfacing. If teeth are chipped or broken they can be replaced. The saw repair facility heats the broken tip with an oxygen and acetylene torch melting the silver solder and removing the tip. Caution; this is a delicate process. Overheating may cause the steel body to be warped and distorted. When soldering new tips in place it is important that they are completely surrounded by a thin layer of silver solder. It is important however, that you compare the cost of sharpening and repair to the cost of new blade. If the blade requires sharpening plus some tip replacement, the cost of repairing can easily exceed the cost of a new one. If you require your Avenger blades to be serviced return them to: **2401 Eastman Ste 19, Oxnard, CA**. We will advise you of the service cost.

SAFETY ISSUES

1. Read instructions for installing and using these tools.
2. Always wear ANSI approved eye, hearing, and dust mask or respirator. A full-face shield is a good idea if you are cutting materials that are likely to chip.
3. Always turn your machine off and unplug electrical cord when changing blades, accessories or servicing the machine.
4. Do not wear jewelry or loose clothing.
5. Make sure that you study the directional arrows on the blades and chippers. Most table saws turn clockwise but some radial arm saws turn the opposite direction.
6. Before beginning to use the accessory, do one final inspection, and make sure that the arbor nut is tight the blades and chippers are properly balanced. Do not run dull blades; do not run these tools at excessive speeds.
7. Keep your hands away from spinning blades and make sure that you have a dado insert in your table so that the material can not fall between the dado set and the table top.
8. Do not attempt to install any kind of dado set on a miter saw, portable circular saw, compound miter saw, or cut-off saw. It is important that you have a stable machine free of vibration and minimal arbor run out tolerance. (.003 maximum run out) This can be checked with a dial indicator and a magnetic base.
9. Carbide is a brittle hard material that can chip or fragment if it strikes rocks, nails, or other foreign objects. Make sure that the material you are cutting is clean. Caution: sharpening these tools with a diamond file or grinding wheel will produce dust with potentially hazardous ingredients, specifically cobalt and tungsten carbide. Make sure you use adequate ventilation and adhere to material safety data information.